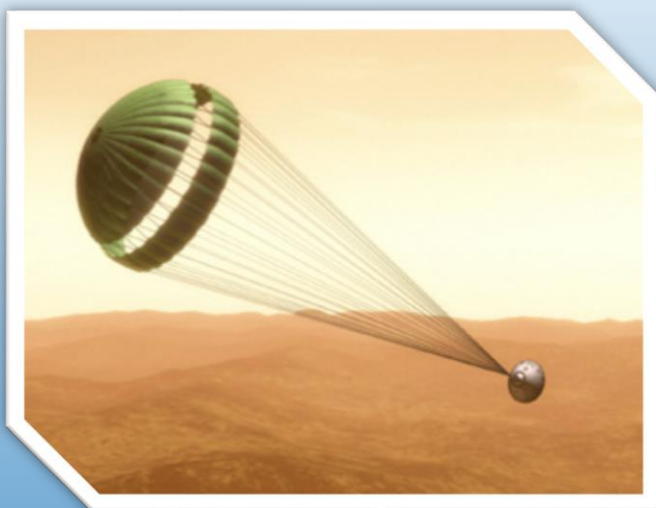


NASA Aerosciences Evaluation and Test Capabilities Project



Dr. Ron Colantonio, Aerosciences Evaluation and Test Capabilities
(AETC) Project Manager

2017 AIAA AVIATION Forum

June 5, 2017



Aerosciences Evaluation and Test Capabilities (AETC) Project



“...Improve access to our facilities, putting them back in the hands of our researchers and engineers to execute the NASA’s missions, programs, and projects...” **NASA Aerosciences Capability Leadership Team**

Vision

- **Sustain** and **improve test capabilities** and **test technologies** in support of NASA testing requirements - *“The right facility at the right time”*

Scope

- Aerospace ground test facilities deemed critical to NASA
- **Operations**, **maintenance**, and **new capability** and **test technology advancements**



Ames Research Center



Glenn Research Center



Langley Research Center

Facility Portfolio



**LaRC 14 x 22 Foot
Subsonic Tunnel**
Subsonic, Alternate Uses



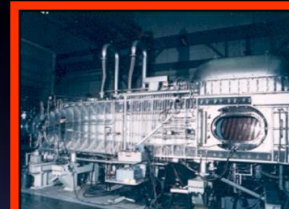
**LaRC National Transonic
Facility**
High Reynolds Number Flow



**ARC Unitary Plan Wind
Tunnels**
11'x11' Transonic Wind Tunnel
9'x7' Supersonic Wind Tunnel



**LaRC Unitary Plan
Wind Tunnel (FY17 Portfolio)**
Supersonic Speed Range



**LaRC Aerothermodynamics
Complex**
Exploration Workhorse

Subsonic

Transonic

Supersonic

Hypersonic



GRC 9'x15' Low Speed Wind Tunnel
Low-speed Propulsion Acoustic
GRC 8'x6' Supersonic Wind Tunnel
Transonic-propulsion



LaRC Transonic Dynamics Tunnel
Aeroelasticity & Flutter



**GRC 10 x 10 Foot
Supersonic Wind Tunnel**
Large-scale Supersonics &
Propulsion



**LaRC 8-Ft High Temperature
Tunnel**
Large-scale Hypersonics &
Propulsion

Specialty Tunnels:



GRC Icing Research Tunnel
Aircraft Icing Condition Simulation



**GRC Propulsion Systems
Laboratory**
Engine (and icing) Simulation at
Altitude



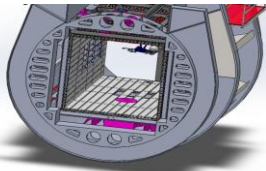
**LaRC 20-Foot Vertical Spin
Tunnel (FY17 Portfolio)**
Spin Characteristics & Dynamic
Stability



AETC Investment Areas



Operations and Maintenance Support for Tunnels Such as the LaRC 14x22 Wind Tunnel



Capability Advancement Support Such as the “Optical Test Section of Tomorrow” at the Ames Unitary Plan Wind Tunnel



Test Technology Support Such as Force and Moment Test Techniques

AETC will invest in **workforce** and **assets** (facilities and related systems and support tools) necessary to **meet technical needs** within **NASA**. The investments are broken down into four elements:

- ✓ **Operations:** Funds directed to key facilities to support labor and procurement needs so that the facilities continue to be available to NASA researchers and projects.
- ✓ **Maintenance:** Funds directed for the maintenance of key facilities to ensure current and future operations while minimizing risk to customer testing.
- ✓ **Capability Advancement:** Funds directed to create new capabilities needed by NASA in specific facilities. They include larger-scale investments in areas such as data systems, tunnel and model controls, new test environments, and facility systems.
- ✓ **Test Technology:** Funds directed to improve measurement capabilities (pressure, force, flow, and temperature), test techniques and processes, and develop technologies critical to meeting NASA research needs and applicable to a multitude of facilities.



AETC Project Structure



Aeronautics Research Mission Directorate (ARMD)

Dr. Jaiwon Shin, Associate Administrator

Human Exploration and Operations Mission Directorate (HEOMD)

Science Mission Directorate (SMD)

Space Technologies Mission Directorate (STMD)

Advanced Air Vehicle Program (AAVP)
Jay Dryer, Director

Ron Colantonio, AETC Project Manager (PM)
Chris Mouring, AETC Deputy PM

Aeroscience Testing Advisory Board

Ames Center POC
Glenn Center POC
Langley Center POC

Business Unit

Lead Analyst
Ames Analyst
Glenn Analyst
Langley Analyst
Subproject Budget Support
Schedulers

Capability Assessment Team Lead

ARMD PM, DoD, Industry and Other Stakeholder Inputs

Test Technology Subproject Manager

Capability Advancements Subproject Manager

Maintenance Subproject Manager





Agency Capability Leadership



NASA is implementing a **Capability Management Model** for capabilities critical to addressing current and future mission needs.

The Capability Leadership Model enables *stewardship* of NASA's critical capabilities, *awareness* by senior management of capability health, and *sustainment* of Center capabilities to meet mission needs. The model approach targets those capabilities that need: (a) a greater coordination and alignment across Mission Directorates and Centers; and, (b) an integrated strategy toward advancement for future Agency objectives.

The implementation is through:

- Increased oversight of capabilities
- Capability Leadership Teams
- Capability (Centralized) Management Programs

Existing Capability Leadership Teams

Discipline & System Areas:

- ✓ **Aerosciences**
- ✓ Avionics
- ✓ Electrical Power
- ✓ Flight Mechanics
- ✓ Guidance Navigation & Control
- ✓ Human Factors
- ✓ Life Support/Active Thermal
- ✓ Loads and Dynamics
- ✓ Materials
- ✓ Mechanical Systems
- ✓ Non-Destructive Evaluation
- ✓ Passive Thermal
- ✓ Propulsion
- ✓ Software
- ✓ Structures
- ✓ Systems Engineering
- ✓ Space Environments
- ✓ Cryogenics
- ✓ Instruments and Sensors

System Areas:

- ✓ Entry, Descent, and Landing
- ✓ Rendezvous and Capture
- ✓ In-Situ Resource Utilization

Other Areas:

- ✓ Life Sciences
- ✓ Earth Science
- ✓ Heliophysics
- ✓ Planetary
- ✓ Astrophysics
- ✓ Aircraft Operations
- ✓ Mission Operations





Vision for the NASA's New Aerosciences Ground Test Funding Model



One of the first NASA Capability Management recommendations was a **New Funding Model for Aerosciences ground test capabilities.**

In **FY17** the New Funding Model will fully cover the operational cost for NASA users of a key set of critical aeroscience ground test facilities. In addition, limited funds are available for capability advancements, new test technologies, and maintenance.

Starting in **FY19** consumables (e.g. power, fuel, etc.) will also be covered.

The primary objective of the New Funding Model is to improve access to our facilities, putting them back in the hands of our NASA researchers and engineers to execute NASA's missions, programs, and projects. The New Funding Model will:

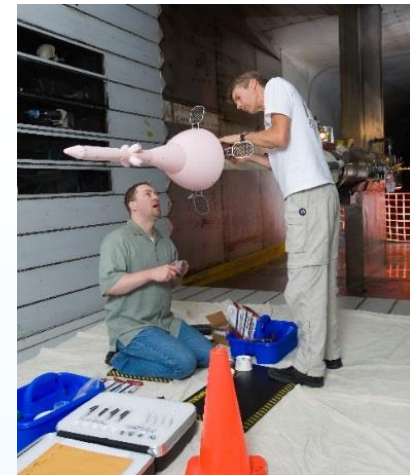
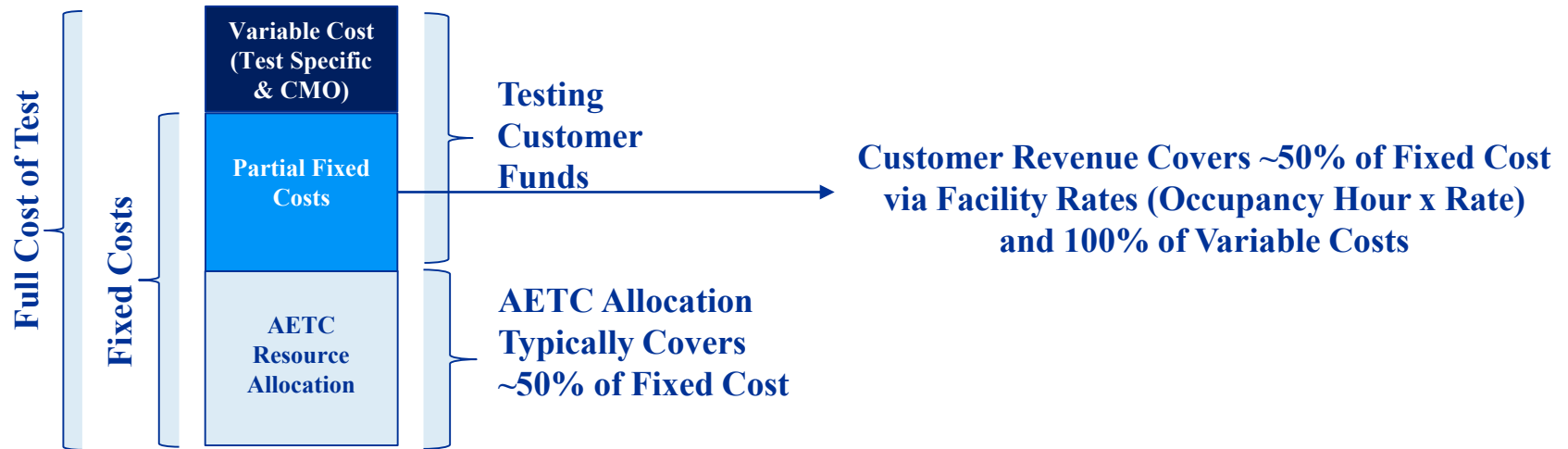
- **Enable technology innovation and risk reduction by providing easier access and remove cost bias that favors computation over test**
- **Reinforce the role of facilities as a NASA centrally managed resource**
- **Improve facility utilization**
- **Enable capability and discipline sustainability**
- **Provide an improved measure for facility decisions involving capability partnering, investment, and divestment**



The NASA **Aerosciences Evaluation and Test Capability (AETC) Project** will manage the aeroscience ground test capability portfolio for the Agency under this New Funding Model.



Operations Cost Recovery Model Previously (FY16 and prior)

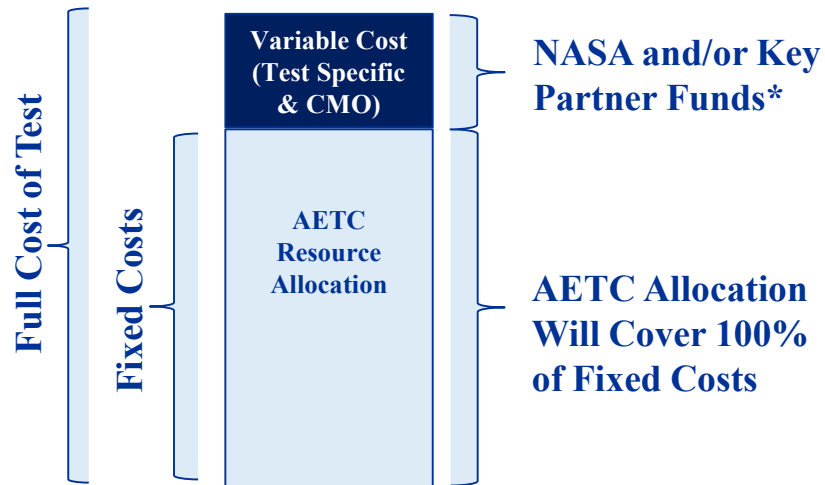




FY17 New Funding Model



NASA Customers (including Ones with Key External Partners)



*This will change in FY19 when consumables become part of the New Funding Model.



What's Covered and What's Not in FY17 from a NASA Customer Perspective



WHAT'S COVERED

Operations labor for planned capacity (civil servant & contractor workforce)
Capability-related procurements such as:
Inventory/Supplies
Fabrication & fabrication quality checks
Facility Operation Consumables
Base Load Consumables (e.g., electricity for shop areas, service air, limited hp air)
Instrumentation and measurement uncertainty
Re-certifications (e.g., pressure systems, lifting systems)
Calibrations (metrology)
Configuration management
Software licenses
IT security
Maintenance of Vehicles and forklifts
Capability-related travel
Workforce development & reshaping (mentoring, training, interns, knowledge capture)



Consumables such as liquid nitrogen, fuel, and power needed for testing are not covered in FY17 and 18 but proposed to be covered in FY19



Facility test operations require both a skilled civil servant and contractor workforce



WHAT'S NOT COVERED

Test Specific and capability-related consumables in FY17 & FY18 (e.g., electricity, hp air, LN2, R-134a, etc.)
Test-specific modifications to capability
Test-specific fabrication (e.g., models and test-specific hardware)
Test-specific instrumentation, engineering support, and DAS
Select Dynamic data systems
Test-specific test techniques:
Sublimation
Oil Flow
IR Thermography
Pressure Sensitive Paint
Particle Image Velocimetry
Schlieren
Background Oriented Schlieren
Computation Fluid Dynamics Services
Test-specific Staffing/Expertise (i.e., beyond capability Ops staff; e.g., Acoustics Engineer)
Non-occupancy overtime
Contract administration
Test-specific travel



Generic Example of Price Change to NASA Customer



Nature of Test:

- 2 weeks of model installation, 4 weeks of large tunnel testing, and 2 weeks of model removal
- Project/Customer supplies the model for testing and research personnel during the test



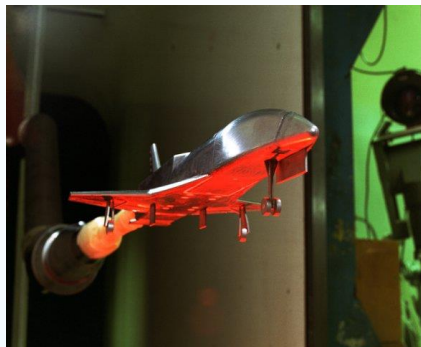
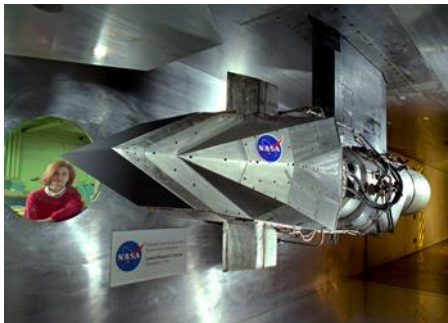
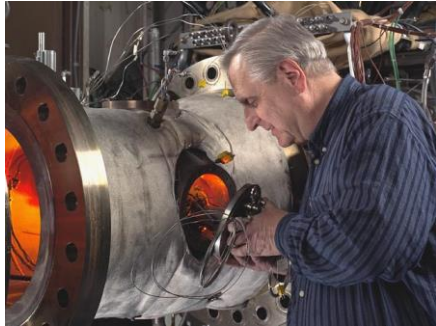
FY16 Testing Cost (\$K) Charged to NASA Customer	
Facility Workforce Cost	\$ 1,245
Capability Related Procurements	\$ 376
Jet Fuel and Nitrogen	\$ 35
Electrical Power	\$ 528
Test Model High Pressure Air	\$ 160
Advanced Schlieren	\$ 25
IR Thermography	\$ 85
Contract Administration	\$ 24
Total	\$ 2,478

FY17/18 Testing Cost (\$K- no inflation adjustment) Charged to NASA Customer	
Facility Workforce Cost	
Capability Related Procurements	
Jet Fuel and Nitrogen	\$ 35
Electrical Power	\$ 528
Test Model High Pressure Air	\$ 160
Advanced Schlieren	\$ 25
IR Thermography	\$ 85
Contract Administration	\$ 24
Total	\$ 857

FY19 and Beyond Testing Cost (\$K- no inflation adjustment) Charged to NASA Customer	
Facility Workforce Cost	
Capability Related Procurements	
Jet Fuel and Nitrogen	
Electrical Power	
Test Model High Pressure Air	\$ 160
Advanced Schlieren	\$ 25
IR Thermography	\$ 85
Contract Administration	\$ 24
Total	\$ 294



Partnerships and External Testing



- **NASA partners can qualify for *sponsored* testing** in the aerosciences ground test facilities if the following apply:
 - Mutually beneficial interests only, and
 - Partner testing is *sponsored* by a NASA project or program, and
 - Testing is documented with a NASA Space Act or Interagency Agreement or NASA Research Announcements (NRA), and
 - One or more of the following apply to required data sharing:
 - Enables and/or increases NASA technology readiness
 - Supports Small Business Innovation Research (SBIR)
 - Lowers NASA research and/or development risks
 - Accelerates NASA technology transfer
 - Reduces risks of NASA contracted deliverables
 - Enables and/or accelerates delivery of NASA contracted deliverable
- The relevant NASA program or project is responsible for substantiating *sponsored* operations testing costs.
- Issues with *sponsored* partnerships will be addressed by a NASA advisory board.
- External customers (non-partners) will continue to pay hourly utilization rates plus consumables plus test-specific costs

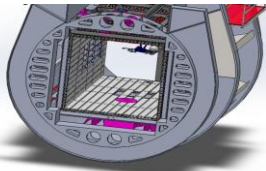
All partnerships must still abide by the Space Act or other agreement or Federal regulations, constraints, and processes (e.g., non-exclusivity). The New Funding Model will not change how we mechanically generate partnership agreements.



Other AETC Investment Areas



Operations and Maintenance Support for Tunnels Such as the LaRC 14x22 Wind Tunnel



Capability Advancement Support Such as the “Optical Test Section of Tomorrow” at the Ames Unitary Plan Wind Tunnel



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New Model Provides Investments in New Capabilities and Maintenance

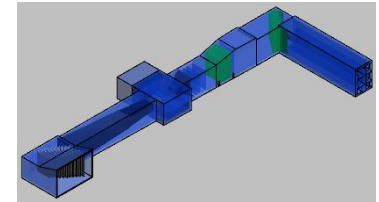


FACILITY CAPABILITY ADVANCEMENTS

1. CC-CA-01 Reduce Background Noise Levels for Engine System Noise Measurements (GRC 9- X 15- Foot Low Speed Wind Tunnel) [FY15-18]
2. CC-CA-02 Optical Improvements for Diagnostic Techniques for Aerodynamic Performance (ARC 11- X 11 And 9- X 7- Foot Wind Tunnels) known as “Optical Test Section of Tomorrow” [FY15-17]
3. CC-CA-03 Methods to Create a Viable and Affordable Freezing Drizzle/Rain Experimental Simulation Capability [FY15-21]
4. CC-CA-04 Demonstrate an Advanced Operational Capability for Propulsion Systems Laboratory (PSL) Engine Icing Tests [FY15-20]
5. **NEW-** CC-CA-05 Full Life Cycle Mach 6 Testing at Long Duration for NASA Langley 8-Foot High Temperature Tunnel [FY17-21]



Optical Test Section of Tomorrow



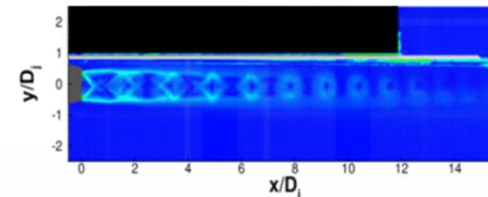
Reduce Background Noise



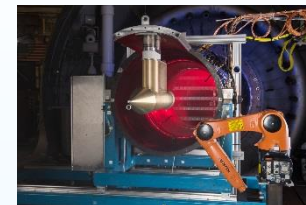
New Icing Capabilities

TEST TECHNOLOGIES

1. CC-TT-01 Optical Instrumentation for Advanced Flowfield Measurements Needed for Next Generation Computational Simulation Development and Validation [FY15-19]
2. CC-TT-02 Force Balance Repeatability and Accuracy to Accommodate Needs of Advanced Aircraft Design Wind Tunnel Models [FY15-19]
3. CC-TT-03 Integrated, NIST-Traceable Calibration and Characterization of Wind Tunnel Facilities [FY15-19]



Optical Instrumentation



Calibration and Characterization



Force Balance

IMPROVED OPERATIONS

1. **NEW-** CC-OPS-01 Propulsion Simulator Test and Calibration Capability to Enable Next Generation Aircraft and Spacecraft Wind Tunnel Testing [FY17-18]
2. **NEW-** CC-OPS-02 Shape Memory Alloy Remote Control Actuation [FY17-19]



Summary



- AETC Project is meeting the needs of NASA and external customers- “The right facility at the right time”
- NASA’s New Funding Model started in FY17 and will improve access to our facilities to better execute NASA’s missions, programs, and projects.
 - Enable technology innovation and risk reduction by providing easier access and remove cost bias that favors computation over test
 - Reinforce the role of facilities as a NASA centrally managed resource
 - Improve facility utilization
 - Enable capability and discipline sustainability
 - Increase opportunities with partners from commercial and outside agencies where mutually beneficial interests and data sharing are present.
- Additional information on the new model, testing at NASA and/or partnership opportunities can be directed to:

Ron Colantonio

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216-433-6370